FIGURE 1

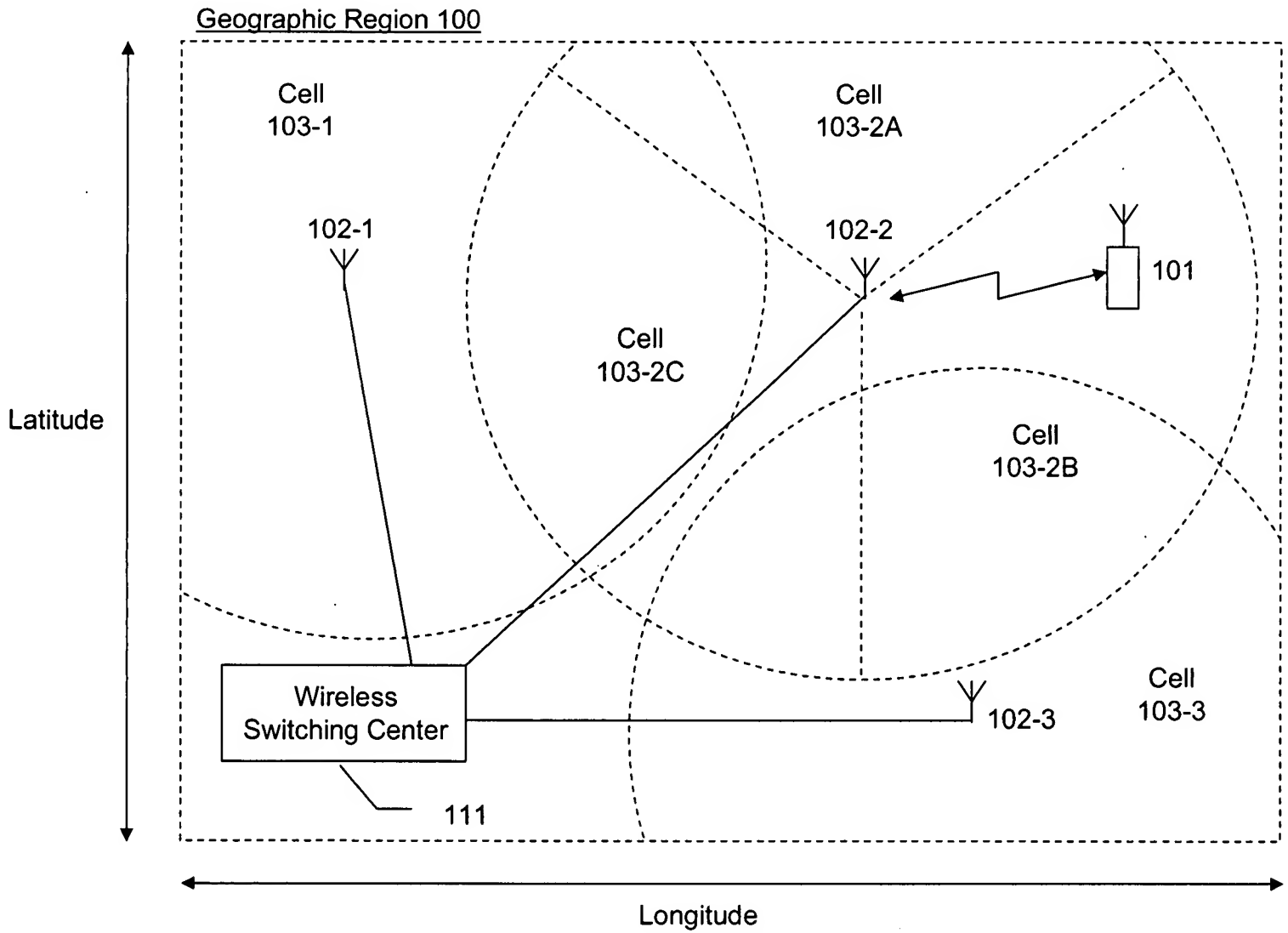
Geographic Region 100
Cell
103-1
Cell
103-2A
102-1
102-2
101
Cell
103-2C
Cell
103-2B
Latitude
Wireless
Switching Center
102-3
Cell
103-3
111
Longitude

FIGURE 2

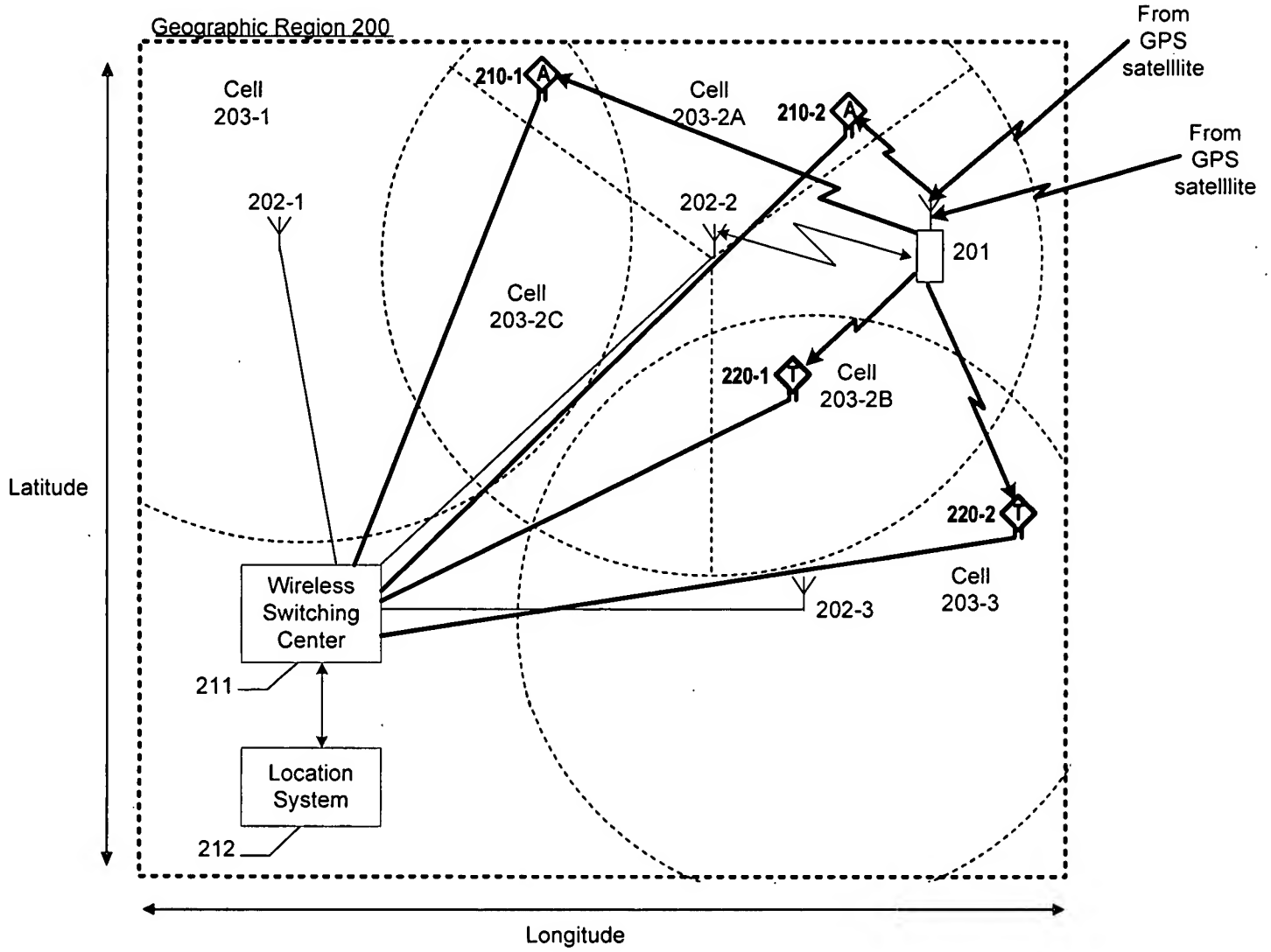
Geographic Region 200
From GPS satelllite
From GPS satelllite
Cell 203-1
210-1
Cell 203-2A
210-2
202-1
202-2
201
Cell 203-2C
220-1
Cell 203-2B
220-2
Cell 203-3
202-3
Wireless Switching Center
211
Location System
212
Latitude
Longitude

FIGURE 3

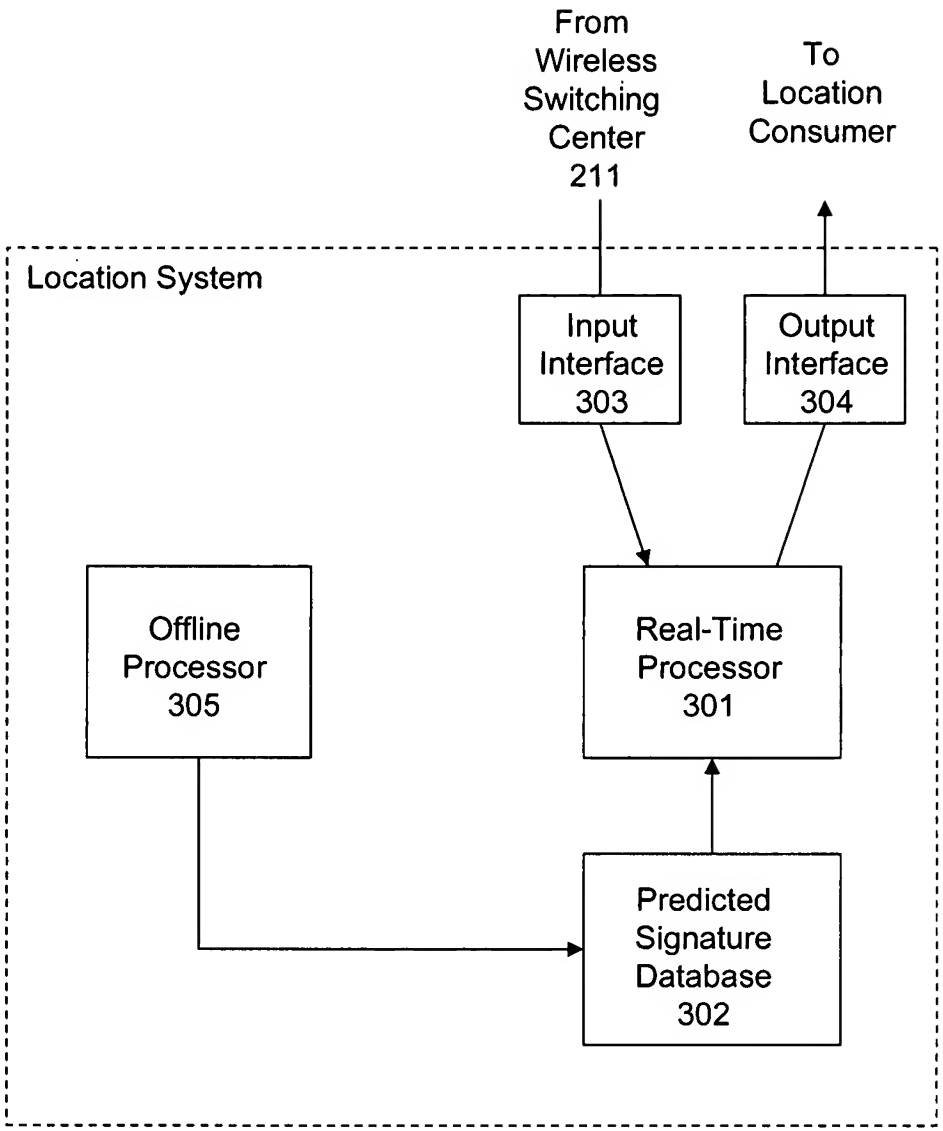
From Wireless Switching Center 211
To Location Consumer
Location System
Input Interface 303
Output Interface 304
Offline Processor 305
Real-Time Processor 301
Predicted Signature Database 302

FIGURE 4

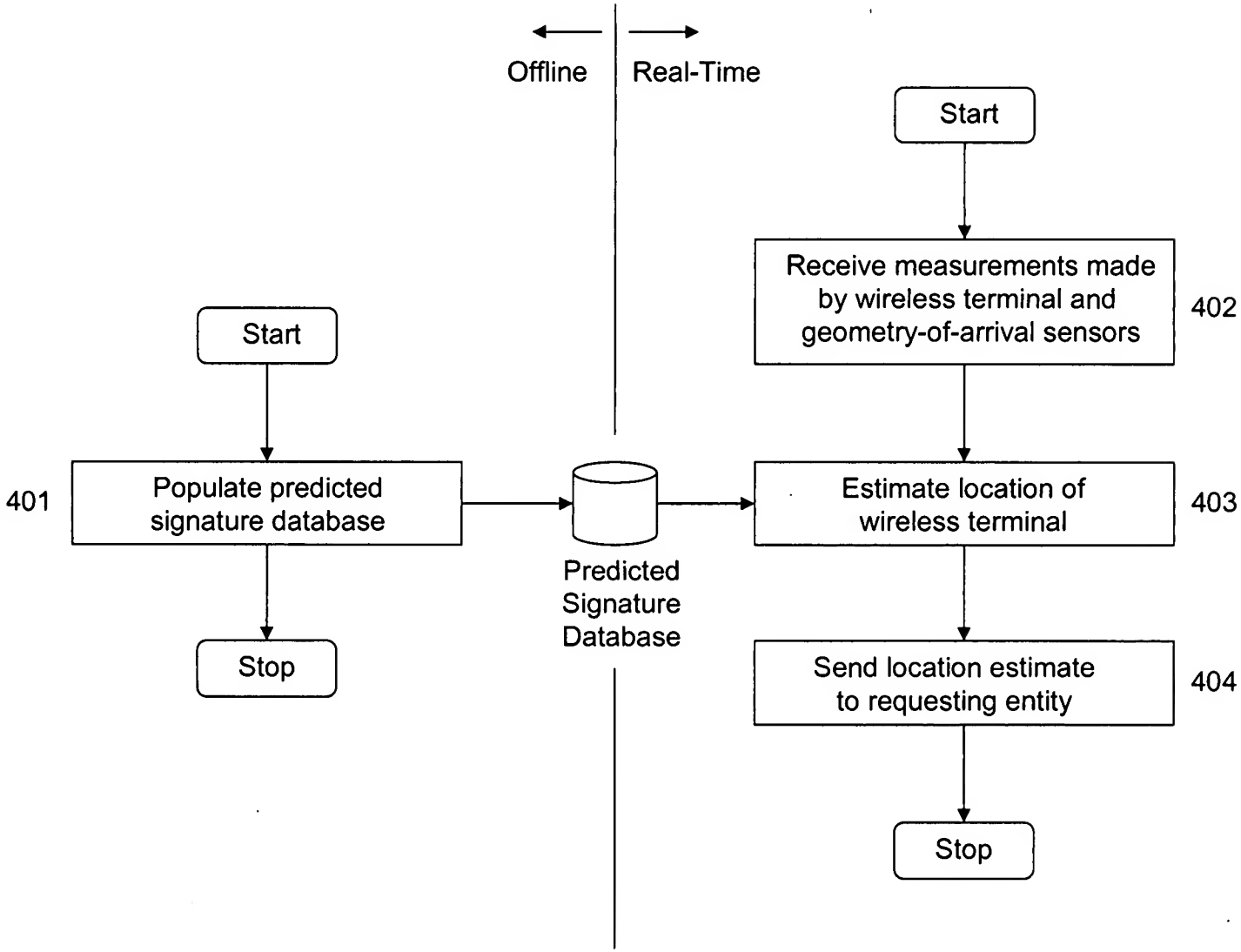
Offline
Real-Time
Start
Receive measurements made by wireless terminal and geometry-of-arrival sensors
402
Start
401
Populate predicted signature database
Predicted Signature Database
Estimate location of wireless terminal
403
Stop
Send location estimate to requesting entity
404
Stop

FIGURE 5

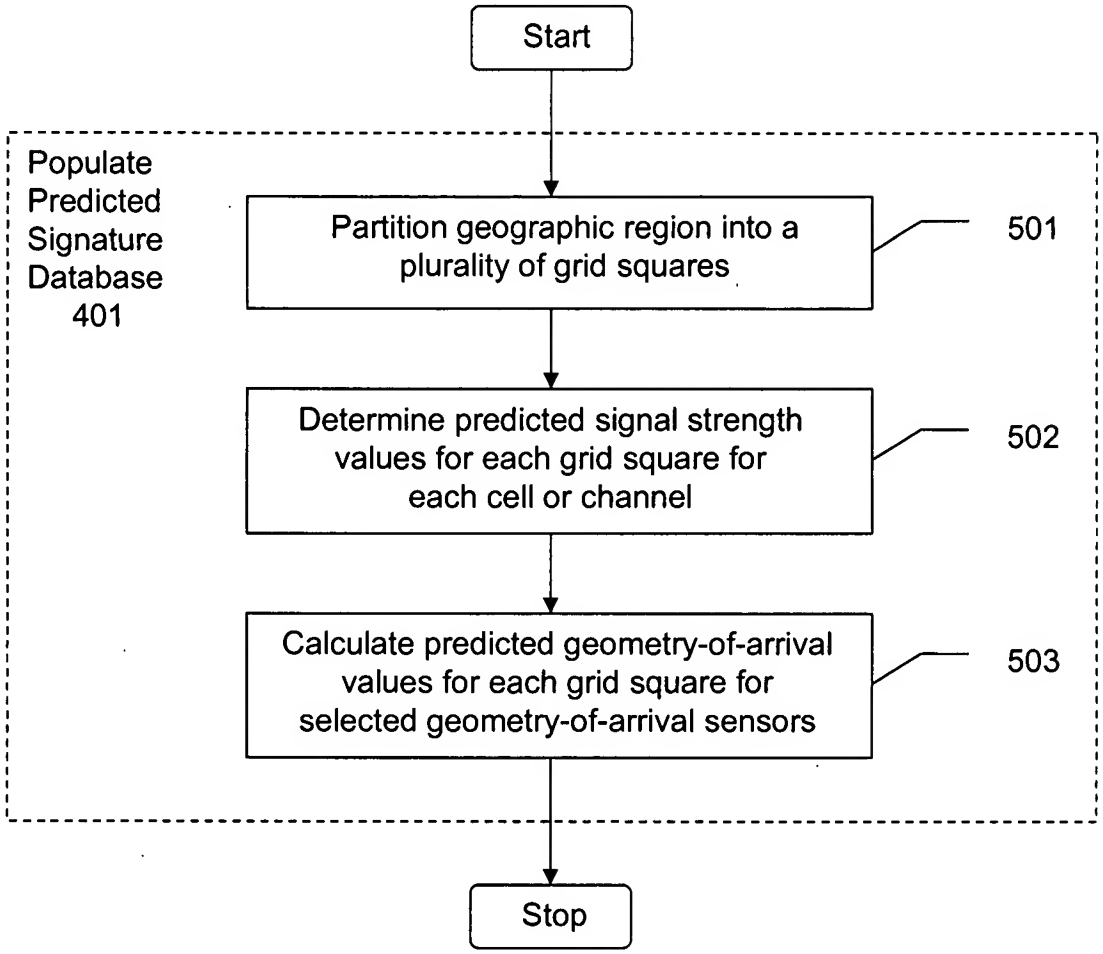
Start
Populate Predicted Signature Database 401
Partition geographic region into a plurality of grid squares
501
Determine predicted signal strength values for each grid square for each cell or channel
502
Calculate predicted geometry-of-arrival values for each grid square for selected geometry-of-arrival sensors
503
Stop

FIGURE 6

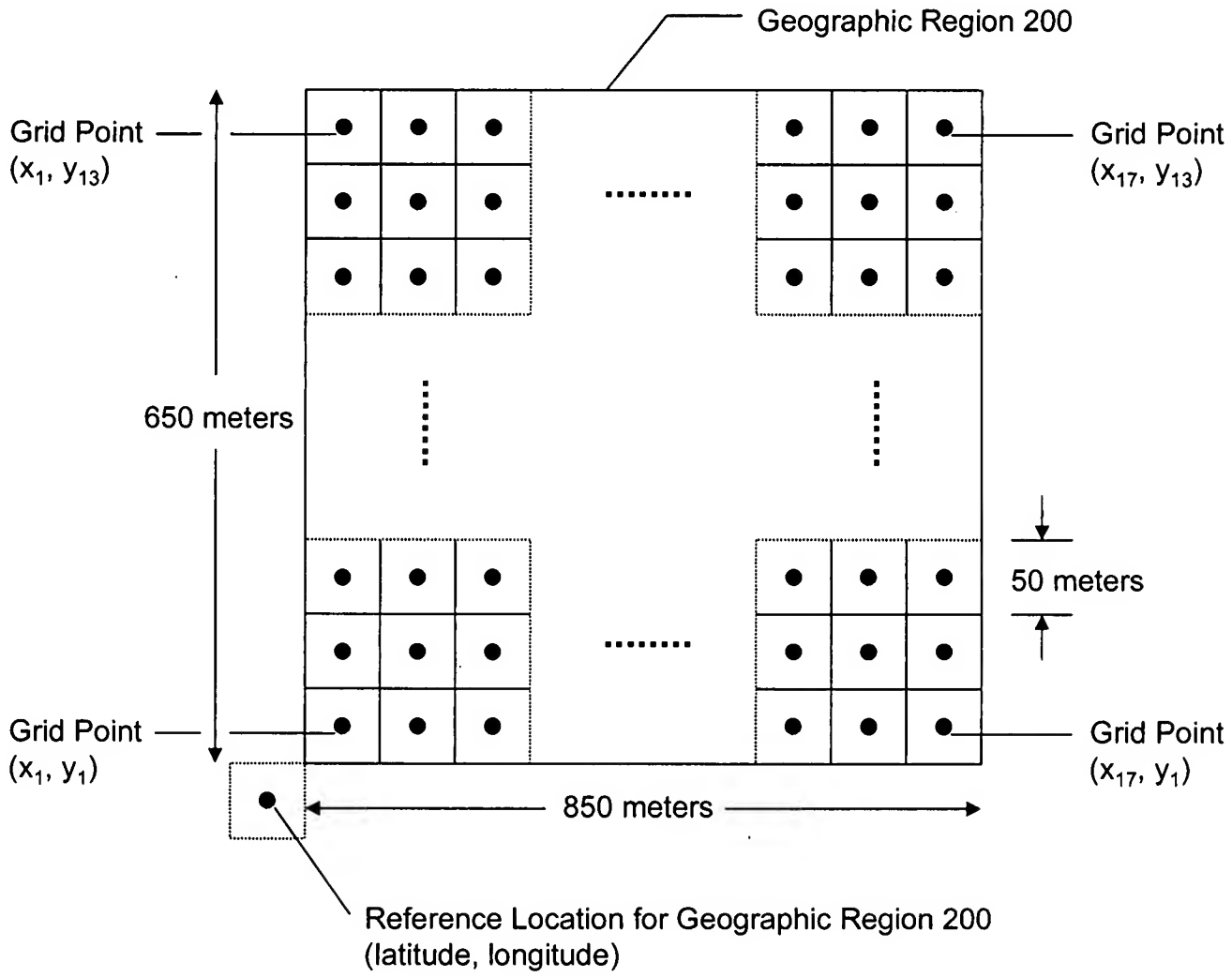
Geographic Region 200
Grid Point
(x_1, y_{13})
Grid Point
(x_{17}, y_{13})
650 meters
50 meters
Grid Point
(x_1, y_1)
Grid Point
(x_{17}, y_1)
850 meters
Reference Location for Geographic Region 200
(latitude, longitude)

FIGURE 7

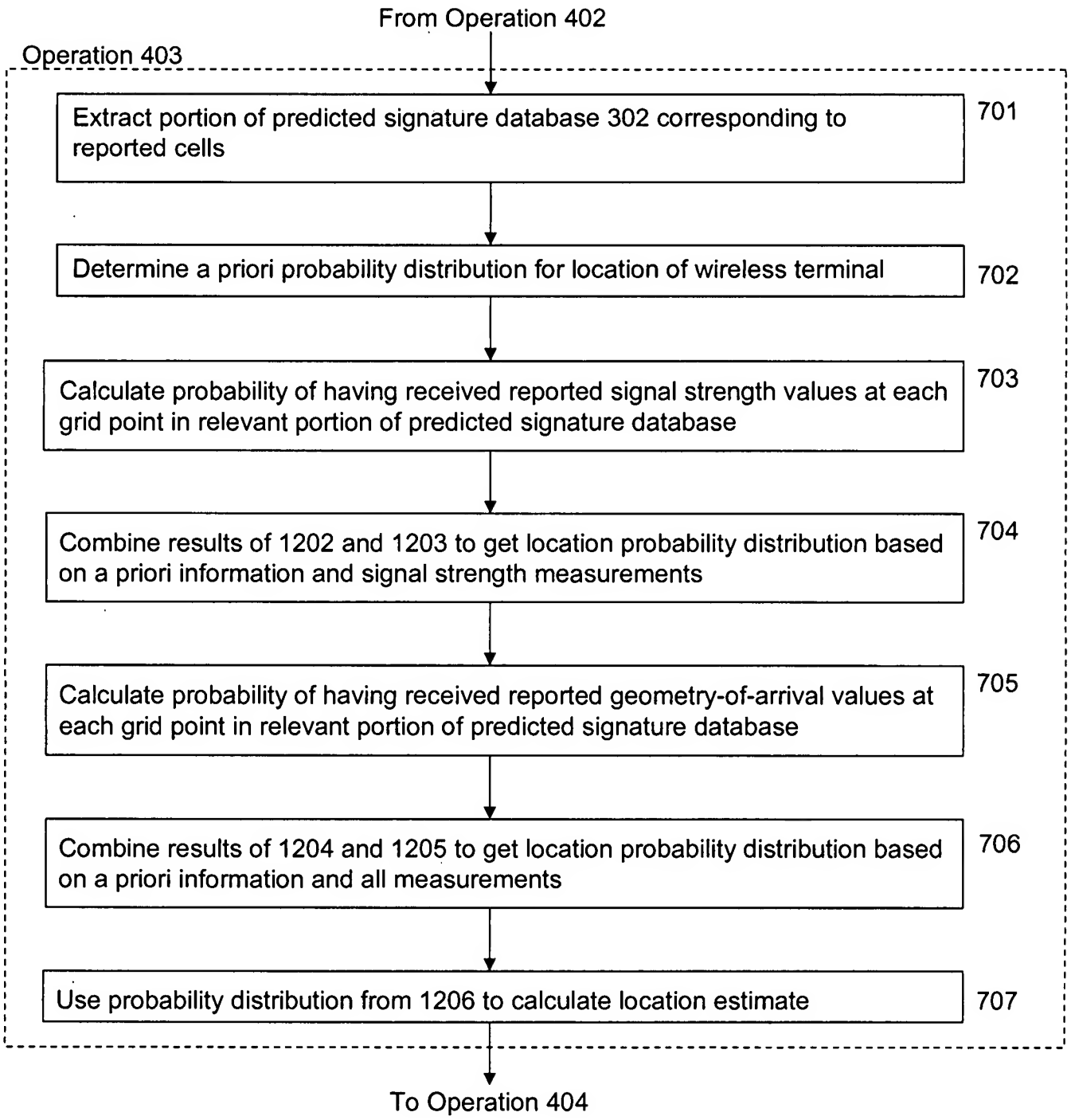
From Operation 402
Operation 403
Extract portion of predicted signature database 302 corresponding to reported cells
701
Determine a priori probability distribution for location of wireless terminal
702
Calculate probability of having received reported signal strength values at each grid point in relevant portion of predicted signature database
703
Combine results of 1202 and 1203 to get location probability distribution based on a priori information and signal strength measurements
704
Calculate probability of having received reported geometry-of-arrival values at each grid point in relevant portion of predicted signature database
705
Combine results of 1204 and 1205 to get location probability distribution based on a priori information and all measurements
706
Use probability distribution from 1206 to calculate location estimate
707
To Operation 404

FIGURE 8

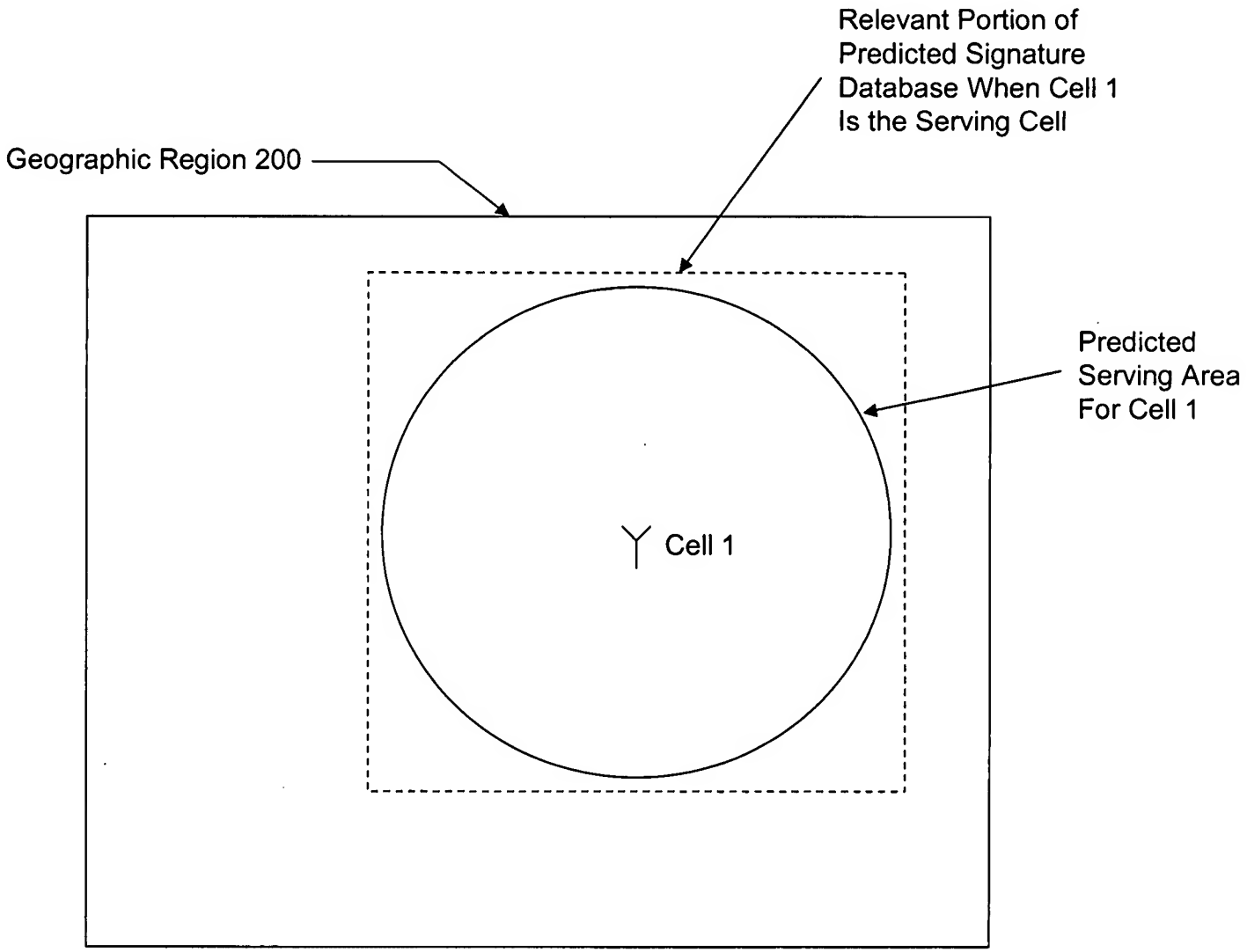
Relevant Portion of
Predicted Signature
Database When Cell 1
Is the Serving Cell
Geographic Region 200
Predicted
Serving Area
For Cell 1
Cell 1

FIGURE 9

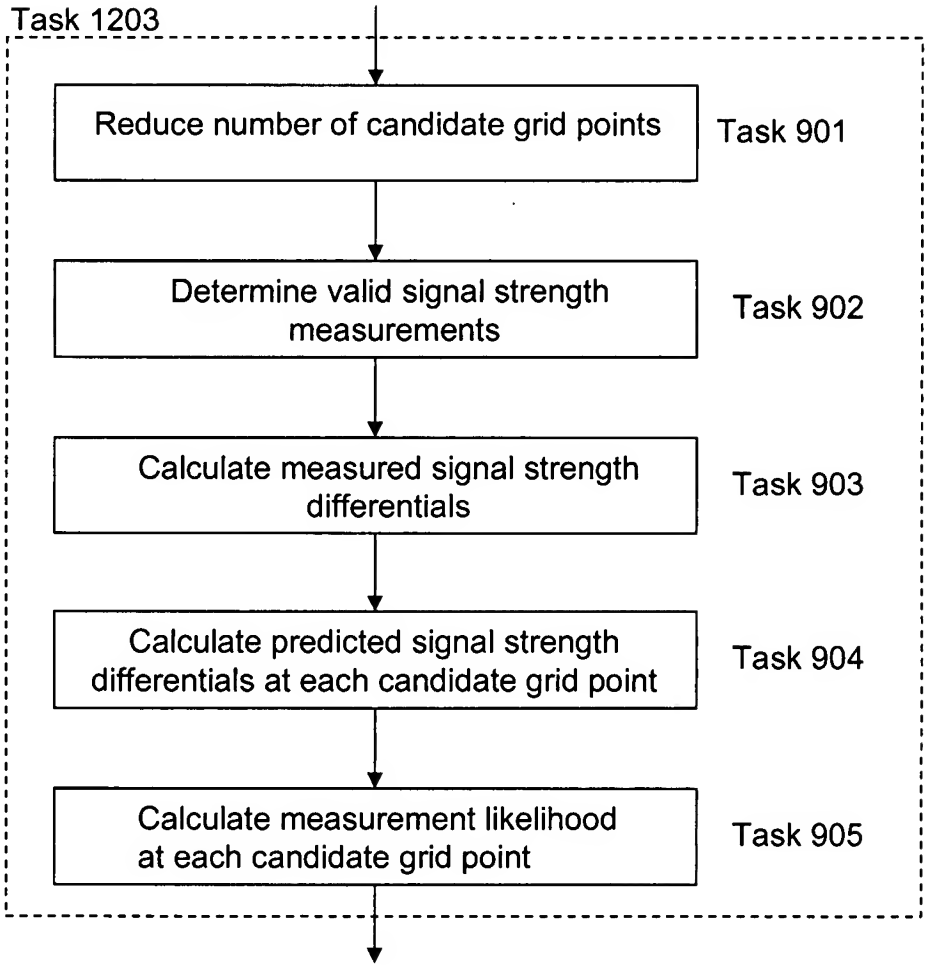
Task 1203
Reduce number of candidate grid points
Task 901
Determine valid signal strength measurements
Task 902
Calculate measured signal strength differentials
Task 903
Calculate predicted signal strength differentials at each candidate grid point
Task 904
Calculate measurement likelihood at each candidate grid point
Task 905

Figure 10

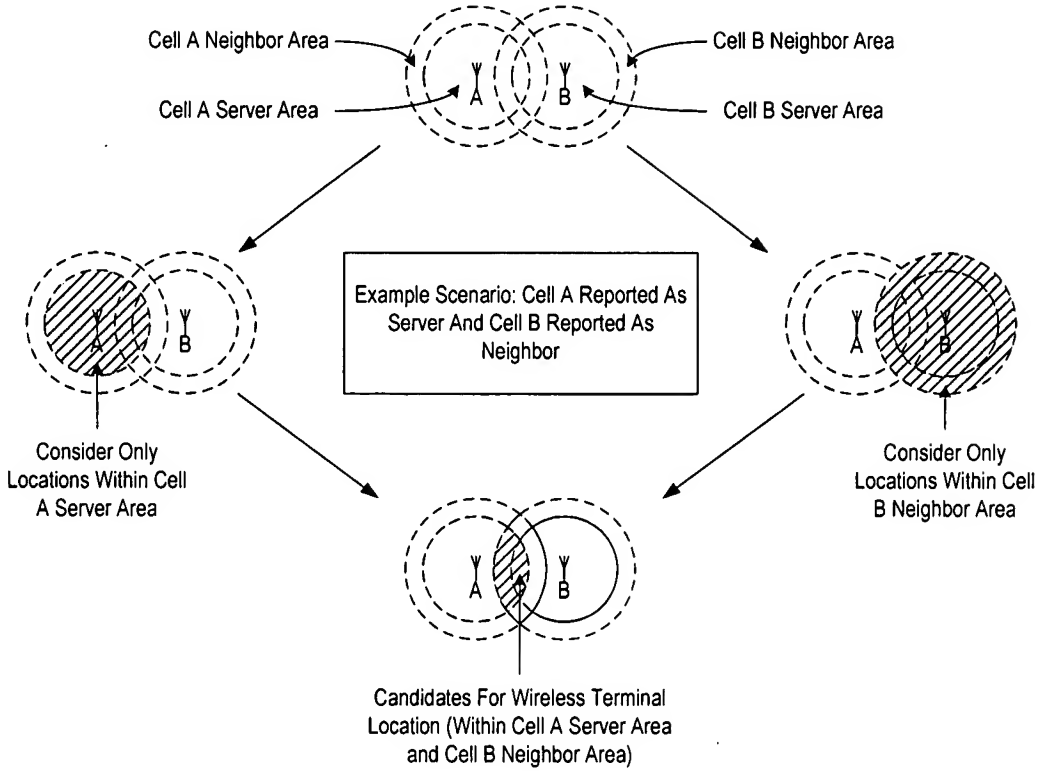
Cell A Neighbor Area
Cell B Neighbor Area
Cell A Server Area
Cell B Server Area
A
B
Example Scenario: Cell A Reported As Server And Cell B Reported As Neighbor
Consider Only Locations Within Cell A Server Area
Consider Only Locations Within Cell B Neighbor Area
Candidates For Wireless Terminal Location (Within Cell A Server Area and Cell B Neighbor Area)

FIGURE 11

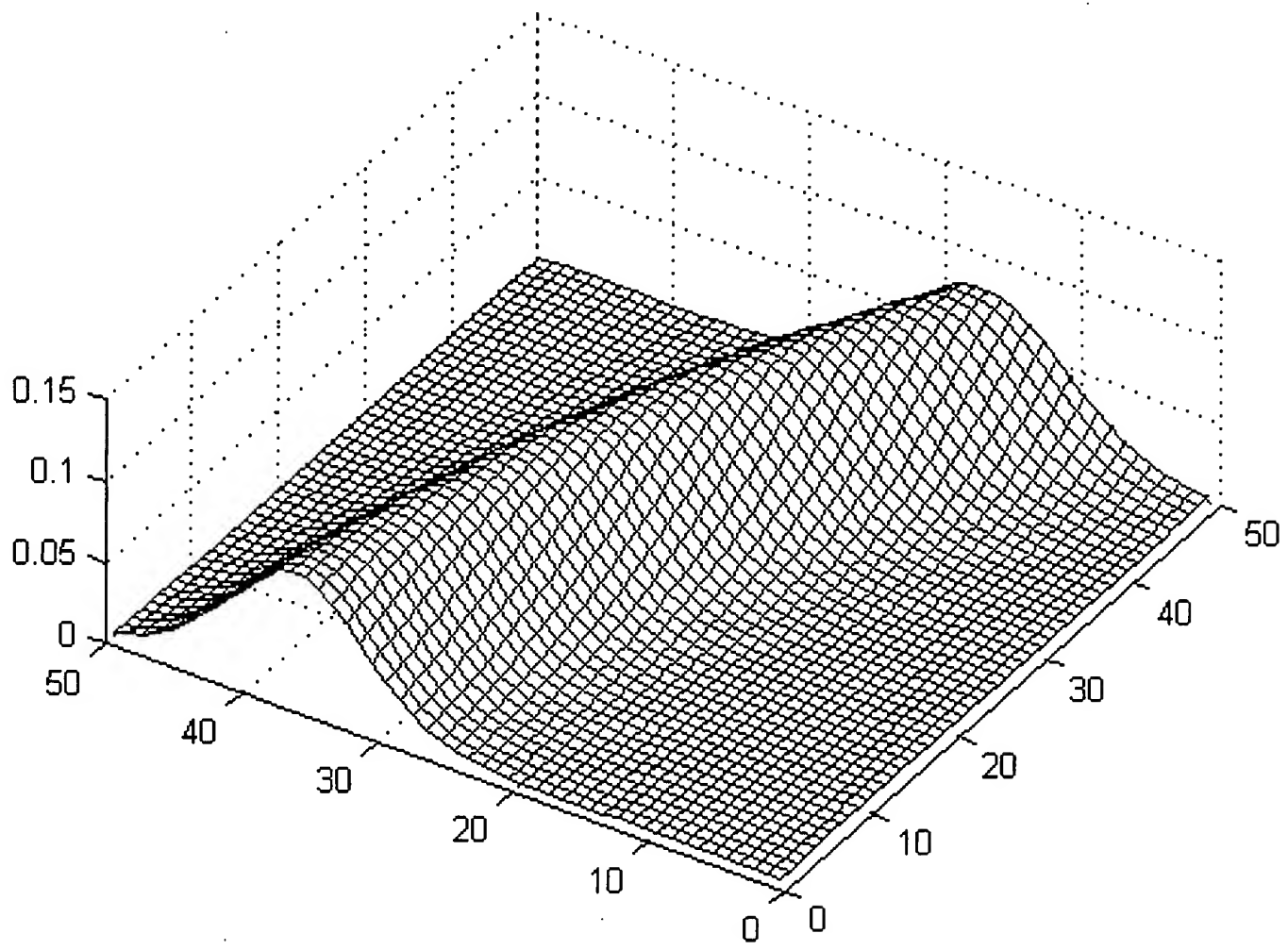
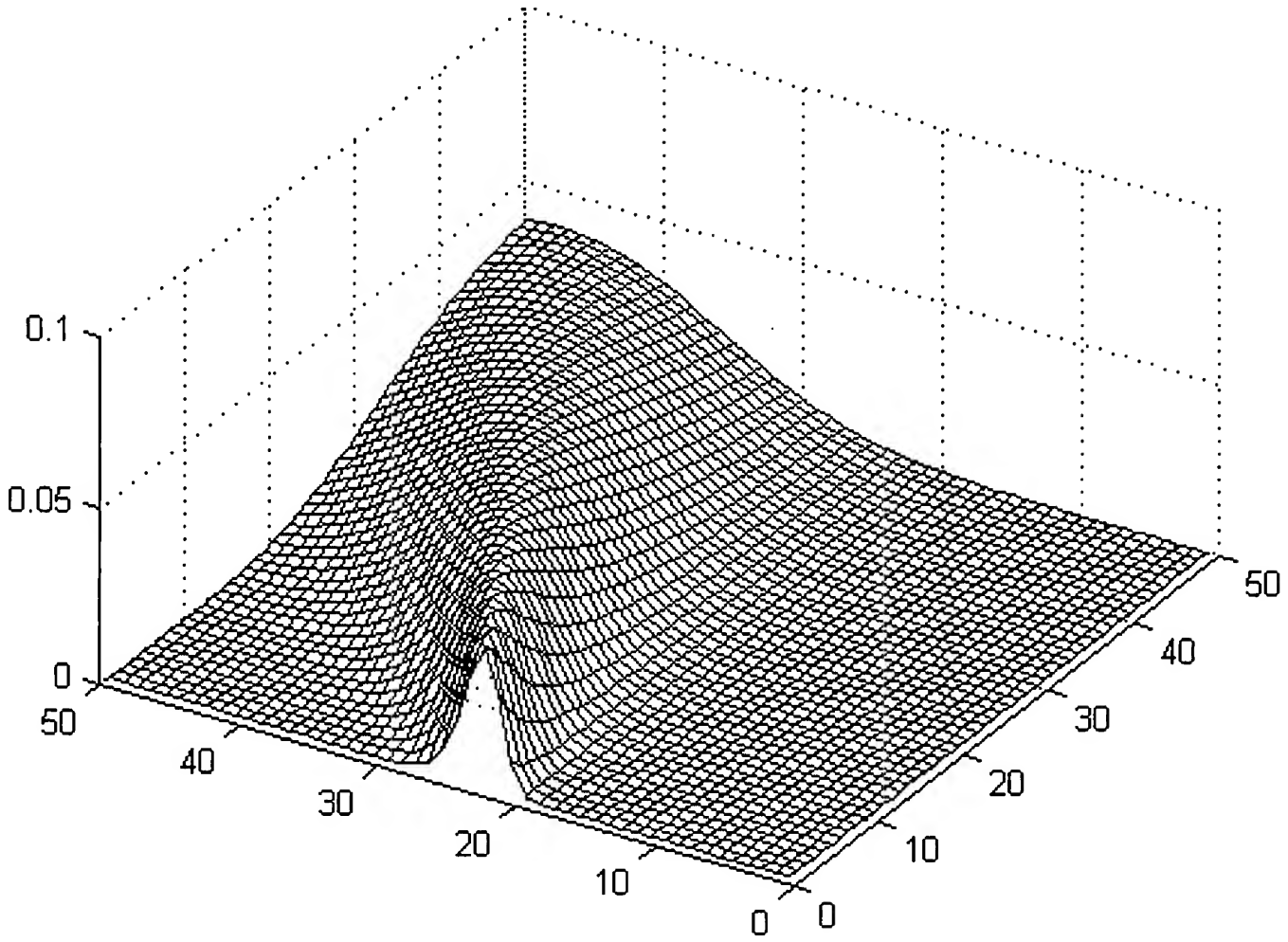
FIGURE 12